

WHAT IS CLAIMED IS:

- 1 1. A method of removing aluminum fluoride deposits from a plasma etch
2 reactor, comprising the steps of:
3 supplying a cleaning gas to a plasma etch reactor, the cleaning gas
4 comprising at least BCl_3 ;
5 cleaning aluminum fluoride deposits from the plasma etch chamber by
6 energizing the cleaning gas into a plasma state such that the BCl_3 gas is dissociated
7 and undissociated BCl_3 reacts with aluminum fluoride deposits in the plasma etch
8 reactor.
- 1 2. The method of Claim 1, wherein the cleaning gas includes Cl_2 , the Cl_2 being
2 supplied to the plasma etch reactor at a rate sufficient to obtain a desired degree of
3 dissociation of the BCl_3 .
- 1 3. The method of Claim 1, further comprising a step of plasma etching a layer
2 of material on a semiconductor wafer, the plasma etching step including a main
3 etch using at least $\text{C}_x\text{H}_y\text{F}_z$ as the main etching gas wherein $x \geq 1$, $y \geq 1$, and $z \geq 0$ and
4 a $\text{C}_x\text{H}_y\text{F}_z$ -free overetch using BCl_3 and optionally Cl_2 as the overetching gas.
- 1 4. The method of Claim 3, further comprising removing the semiconductor
2 wafer from the plasma etch reactor prior to supplying the cleaning gas to the
3 plasma etch reactor.

- 1 5. The method of Claim 3, wherein the layer of material comprises an
2 aluminum layer and the main etching gas comprises $C_xF_yH_z$ wherein $x \geq 1$, $y \geq 1$,
3 and $z \geq 0$, Cl_2 , N_2 and BCl_3 .
- 1 6. The method of Claim 3, wherein $C_xF_yH_z$ comprises CF_4 , CHF_3 or mixture
2 thereof.
- 1 7. The method of Claim 1, further comprising a step of conditioning the plasma
2 etch chamber after the cleaning step.
- 1 8. The method of Claim 1, wherein the plasma etch reactor comprises an ECR
2 plasma reactor, an inductively coupled plasma reactor, a capacitively coupled
3 plasma reactor, a helicon plasma reactor or a magnetron plasma reactor.
- 1 9. The method of Claim 1, wherein pressure in the plasma etch reactor is 5 to
2 40 mTorr, 40 to 200 mTorr or 200 to 1000 mTorr.

1 10. The method of Claim 1, wherein the plasma etch reactor is an inductively
2 coupled plasma reactor having an antenna which inductively couples radio
3 frequency energy into an interior of the plasma etch reactor through a dielectric
4 member, the plasma etch reactor including a bottom electrode on which the
5 semiconductor substrate can be supported, the antenna being powered with 100 to
6 3000 watts during the cleaning step and the bottom electrode being powered with 0
7 to 3000 watts during the cleaning step.

1 11. A method of reducing aluminum fluoride deposits formed in a plasma etch
2 reactor during processing of a semiconductor substrate, comprising steps of:
3 supporting a semiconductor substrate in a plasma etch reactor;
4 supplying an etching gas to the plasma etch reactor;
5 etching a layer on the semiconductor substrate during a main etch by
6 energizing the etching gas into a plasma state, the etching gas used during the main
7 etch including $C_xF_yH_z$ wherein $x \geq 1$, $y \geq 1$, $z \geq 0$, the main etch resulting in
8 buildup of aluminum fluoride deposits on interior chamber surfaces exposed to the
9 plasma within the plasma etch reactor;
10 etching the layer on the semiconductor substrate during an overetch etch by
11 energizing the etching gas into a plasma state, the etching gas used during the
12 overetch including BCl_3 which is at least partially dissociated in the plasma, the
13 undissociated BCl_3 reducing the buildup of aluminum fluoride deposits on the
14 interior chamber surfaces.

1 12. The method of Claim 11, wherein the etching gas used during the overetch
2 is $C_xF_yH_z$ -free and includes Cl_2 in an amount relative to the BCl_3 to provide a
3 desired degree of dissociation of the BCl_3 .

1 13. The method of Claim 11, wherein the layer comprises an aluminum layer
2 covered with a patterned photoresist, the main etch forming a pattern of conductor
3 lines in the aluminum layer.

1 14. The method of Claim 11, wherein the etching gas includes Cl_2 and/or BCl_3
2 during the main etch.

1 15. The method of Claim 11, further comprising removing the semiconductor
2 substrate from the plasma etch reactor and cleaning the interior chamber surfaces
3 by energizing a cleaning gas into a plasma state.

1 16. The method of Claim 15, wherein the cleaning gas includes O_2 , Cl_2 and/or
2 BCl_3 .

1 17. The method of Claim 15, wherein the etching gas during the main etch
2 includes at least CHF_3 and the cleaning gas includes BCl_3 and Cl_2 , the Cl_2 being
3 added in an amount relative to the BCl_3 to provide a desired degree of dissociation
4 of the BCl_3 .

1 18. The method of Claim 11, wherein the etching gas is supplied into the
2 plasma etch reactor through a gas distribution plate (GDP) and the semiconductor
3 substrate is a silicon wafer supported on a substrate support having a uniformity
4 ring around an outer periphery of the wafer, the interior chamber surfaces
5 including the gas distribution plate, the uniformity ring and a chamber wall
6 surrounding the substrate support, the overetch step reducing buildup of aluminum
7 fluoride deposits on the GDP, the uniformity ring and/or the chamber wall.

1 19. The method of Claim 11, wherein the semiconductor substrate comprises a
2 silicon wafer having a layer of aluminum thereon, the etching gas during the main
3 etch comprising CHF_3 supplied to the plasma etch reactor at a flow rate of less
4 than 10 sccm.

1 20. The method of Claim 11, wherein the plasma etch reactor comprises an
2 inductively coupled plasma reactor having an antenna which couples 100 to 3000
3 watts of RF power into an interior of the plasma etch reactor through a dielectric
4 member, the plasma etch reactor including a bottom electrode on which the
5 semiconductor substrate is supported, the bottom electrode being supplied 0 to
6 3000 watts RF power during the main etch and overetch steps.